REMARKS

Claims 1-19, 21-24, 26-29, 31-39 and 41-49 are pending in the present application. Claims 1-19, 21-24, 26-29 and 31-39 have been examined and are rejected. In the above amendments, claims 1, 3-5, 8-11, 13-17, 21-24, 26, 27, 31, 32, 37, 38, 41 and 49 have been amended. Therefore, after entry of the above amendments, claims 1-19, 21-24, 26-29, 31-39 and 41-49 will be pending in this application. Applicant believes that the present application is now in condition for allowance, for which prompt and favorable action is respectfully requested.

Rejection of Claims Under 35 U.S.C. §112, First Paragraph

Claims 1, 3-19, 21-29, 39 and 42-49 stand rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. The rejection states that the recited limitation "each symbol block including different coded information" is not described in the original specification. Applicant respectfully disagrees.

Paragraph [0046] of the present application recites:

> "[0046] Referring back to FIG. 4A, a partitioning unit 416 receives and partitions the coded packet into N_B coded subpackets, where N_B may be dependent on the selected rate and indicated by a partitioning control from controller 140. The first coded subpacket typically contains all of the systematic bits and zero or more parity bits. This allows the receiver to recover the data packet with just the first coded subpacket under favorable channel conditions. The other N_B-1 coded subpackets contain the remaining first and second parity bits. Each of these N_B-1 coded subpackets typically contains some first parity bits and some second parity bits, with the parity bits being taken across the entire data packet. For example, if N_B=8 and the remaining first and second parity bits are given indices starting with 0, then the second coded subpacket may contain bits 0, 7, 14, … of the remaining first and second parity bits, the third coded subpacket may contain bits 1, 8, 15, … of the remaining first and second parity bits, and so on, and the eighth and last coded subpacket may contain bits 6, 13, 20, … of the remaining first and second parity bits. Improved decoding performance may be achieved by spreading the parity bits across the other N_B-1 coded subpackets." (Emphasis added.)

As clearly described in paragraph [0046], a coded packet may be partitioned into a plurality of coded subpackets, with each subpacket including different code bits (or coded information) of the coded packet. Paragraph [0047] states "each block interleaver 422 interleaves (i.e., reorders) the code bits for its subpacket in accordance with an interleaving scheme and provides an interleaved subpacket." Paragraph [0048] states "a symbol mapping unit 426 receives the interleaved subpackets … and maps the interleaved data in each subpacket to modulation symbols. … Symbol mapping unit 426 provides a block of data symbols for each coded subpacket." Thus, each block of symbols is generated based on one subpacket of code bits or coded information. Different blocks of symbols are generated based on different subpackets containing different code bits/coded information.

Applicant respectfully submits that the present application provides clear and ample support for the feature "each symbol block including different coded information" recited in the present claims.

Accordingly, the §112, first paragraph, rejection of claims 1, 3-19, 21-29, 39 and 42-49 should be withdrawn.

Rejection of Claims Under 35 U.S.C. §112, Second Paragraph

Claims 1, 3-7, 9-19, 21-24, 26-29 and 31-49 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. The Examiner cites various phrases/limitations in the present claims as being vague and indefinite. Applicant respectfully submits that these phrases are clearly described in the claims and the specification. Nevertheless, Applicant will address each offending phrase below.

For claims 1, 7, 10, 13 and 41, the phrase "selected rate" is deemed vague and indefinite. Paragraph [0030] of the present application states "the selected rate for each data packet may indicate the data rate, coding scheme or code rate, modulation scheme, packet size, number of data symbol blocks, and so on, for that packet" (emphasis added). Depending on system implementation, the selected rate may be mapped to one, some, or all of the parameters listed above. Applicant submits that the "selected rate" is clearly described in the present application and would be understood by one of ordinary skill in the art. Nevertheless, to expedite the prosecution of the present application, independent claims 1, 10,

13 and 41 have each been amended to recite the selected rate indicating one or more of the parameters listed above.

For claim 5, the phrase "receiving a negative acknowledgement (NAK)" is deemed vague and indefinite because it is not clear which element receives the NAK message. Claim 5 has been amended to recite the transmitter receiving the NAK message.

For claim 9, the phrase "wherein N_P data packets" is deemed to have insufficient antecedent basis. Claim 9 has been amended to recite "processing each of N_P data packets".

For claim 16, the phrases "obtaining a block of received symbols for the data symbol block" and "detecting the received symbol block to obtain the detected symbol block" are deemed vague and indefinite. Claim 16 has been amended to recite "receiving a block of received symbols corresponding to the data symbol block" and "processing the received symbol block to obtain the detected symbol block."

For claim 22, the phrase "selecting a rate" is deemed vague and indefinite. Claim 22 has been amended to recite the selected rate indicating one or more of the parameters listed in the claim.

For claim 24, the phrase "a detector operative to obtain a block of received symbols for the data symbol block and to detect the received symbol block to obtain the detected symbol block," is deemed vague and indefinite. Claim 24 has been amended to recite "a receive spatial processor operative to obtain a block of received symbols … and to process the received symbol block to obtain the detected symbol block." The receive spatial processor is clearly shown in FIG. 8A of the present application.

For claims 28, 33, 35 and 37, the phrase "final iteration" is deemed vague and indefinite. The rejection states that "range of iterations must be specified otherwise it creates an infinite loop." Claim 28 recites "performing the <u>detecting and decoding</u> for a plurality of iterations" and "generating a decoded packet based on an output from the decoding for <u>a final iteration among the plurality of iterations</u>." The final iteration clearly refers to the last iteration among the plurality of iterations being performed. Furthermore, the claims clearly recite iterating the "detecting and decoding" steps.

For claims 32 and 37, the phrase "where N is one or greater" is deemed vague and indefinite because it can create infinite number of possibilities. Claims 32 and 37 have been amended to recite "at least one iteration."

Accordingly, the §112, second paragraph, rejection of claims 1, 3-7, 9-19, 21-24, 26-29 and 31-49 should be withdrawn.

Rejection of Claims 1, 3, 5-14 and 41 Under 35 U.S.C. §103(a)

Claims 1, 3, 5-14 and 41 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Piiranien (US 7,031,419) in view of Applicant Admitted Prior Art (AAPA) and further in view of Lakkis (US 7,031,371).

Claim 1 of the present application, as amended, recites:

> "A method of performing incremental redundancy (IR) transmission in a wireless multiple-input multiple-output (MIMO) communication system, comprising:
>
> obtaining a selected rate for data transmission on a MIMO channel between a plurality of transmit antennas at a transmitter and a plurality of receive antennas at a receiver, the selected rate indicating a particular data rate, or a particular coding scheme, or a particular code rate, or a particular modulation scheme, or a particular data packet size, or a combination thereof;
>
> processing a data packet in accordance with the selected rate to obtain a plurality of symbol blocks, each symbol block including different coded information for the data packet;
>
> transmitting a first symbol block from the plurality of transmit antennas at the transmitter to the plurality of receive antennas at the receiver, wherein the first symbol block is one of the plurality of symbol blocks; and
>
> transmitting remaining ones of the plurality of symbol blocks, one symbol block at a time, until the data packet is recovered correctly by the receiver or all of the plurality of symbol blocks are transmitted, wherein each of the plurality of symbol blocks is transmitted at most once to the receiver."

Applicant submits that claim 1 is patentable over Piiranien in view of AAPA and Lakkis for at least the following reasons.

First, the combination of Piiranien, AAPA and Lakkis does not disclose "obtaining a selected rate for data transmission on a MIMO channel," and "processing a data packet in accordance with the selected rate to obtain a plurality of symbol blocks" (emphasis added), as recited in claim 1. The Examiner states that Piiranien does not expressly teach obtaining a selected rate for data transmission on a MIMO channel. The Examiner then states that

paragraph [0006] of AAPA teaches this limitation. Paragraph [0006] states "the transmitter typically processes and transmits each data packet at the rate selected for that data packet." Paragraph [0006] further states "the transmitter may retransmit each data packet decoded in error by the receiver, in its entirety, upon receiving a NAK from the receiver for the packet." Thus, each data packet is processed to generate a single symbol block, which is transmitted in its entirely if the data packet is decoded in error. AAPA does not describe processing a data packet in accordance with the selected rate to obtain a plurality of symbol blocks, which can be transmitted one symbol block at a time, as recited in claim 1.

The rejection also cites column 9, lines 61-63 of Piiranien as describing the "selection" feature of claim 1. This cited section of Piiranien describes selection of matrices A and B used for space-time block coding. As is known by one skilled in the art, space-time block coding is performed on modulation symbols. Space-time block coding is different than "channel coding" performed on a data packet to generate coded information, which can then be used to form modulation symbols. The selection in the cited section of Piiranien is thus unrelated to the selected rate recited in claim 1.

Second, the combination of Piiranien, AAPA and Lakkis does not disclose "each symbol block including different coded information for the data packet" (emphasis added), as recited in claim 1. The rejection states that Piiranien and AAPA do not teach this feature of claim 1 but that Lakkis describes this feature in column 1, line 40, column 7, lines 24-25, and column 8, lines 64-67. FIG. 3 of Lakkis shows a transmitter 22 that includes an encode & interleave section 58, followed by several other sections, then followed by a spreading section 72, etc. Section 58 performs channel coding and encodes and interleaves an input stream of data. (See column 4, lines 64-66.) Spreading section 72 performs spreading applies spreading codes to M unspread substreams to form M spread substreams of chips. (See column 5, lines 47-50.) The cited sections of Lakkis refer to different spreading codes used for spreading data. These spreading codes are totally different from the channel coding performed by section 58. Spreading is performed to orthogonalize different streams of data being transmitted simultaneously. Channel coding is performed to generate coded information that can better withstand noise and other artifacts in a communication channel. The cited sections of Lakkis do not refer to channel coding of data. More particularly, the cited sections of Lakkis do not describe "processing a data packet … to obtain a plurality of symbol blocks, each symbol block including different coded information for the data packet,"

as recited in claim 1. Furthermore, the cited sections of Lakkis refer to different codes whereas claim 1 recites the plurality of symbol blocks (with different coded information) being generated based on a single selected rate.

Third, the combination of Piiranien, AAPA and Lakkis does not disclose "wherein each of the plurality of symbol blocks is transmitted at most once to the receiver" (emphasis added), as recited in claim 1. Piiranien describes "retransmitting the same blocks" if there is reception failure. (See the Abstract.).

For at least the above reasons, Applicant submits that claim 1 is patentable over Piiranien in view of AAPA and Lakkis. Claims 5-7 and 9 are dependent on claim 1 and are patentable for at least the reasons noted above for claim 1. These dependent claims may recite additional features not disclosed nor suggested by Piiranien, AAPA and Lakkis.

Independent claims 8, 10, 13 and 41 each recites the features noted above for claim 1. Claims 11 and 12 are dependent on claim 10, and claim 14 is dependent on claim 13. Claims 8-14 and 41 are patentable over the combination of Piiranien, AAPA and Lakkis for at least the reasons noted for claim 1.

Accordingly, the §103(a) rejection of claims 1, 3, 5-14 and 41 should be withdrawn.

Rejection of Claims 15-19, 22-24, 26-29, 31-40 and 49 Under 35 U.S.C. §103(a)

Claims 15-19, 22-24, 26-29, 31-40 and 49 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Tarokh (US 2004/0057530) in view of Lakkis (US 7,031,371).

Claim 15 of the present application recites:

> "A method of receiving an incremental redundancy (IR) transmission in a wireless multiple-input multiple-output (MIMO) communication system, comprising:
>
> obtaining a block of detected symbols for a data packet, wherein the detected symbol block is an estimate of a data symbol block transmitted from a plurality of transmit antennas at a transmitter and received by a plurality of receive antennas at a receiver, and wherein the data symbol block is one of a plurality of data symbol blocks generated for the data packet, each data symbol block including different coded information for the data packet and being transmitted at most once to the receiver;
>
> decoding all detected symbol blocks obtained for the data packet to provide a decoded packet;

determining whether the decoded packet is correct or in error; and

repeating the obtaining, decoding, and determining for another one of the plurality of data symbol blocks if the decoded packet is in error."

Applicant submits that claim 15 is patentable over Tarokh in view of Lakkis for at least the following reasons.

First, the combination of Tarokh and Lakkis does not disclose "obtaining a block of detected symbols for a data packet, wherein the detected symbol block is an estimate of a data symbol block …, and wherein the data symbol block is one of a plurality of data symbol blocks generated for the data packet, each data symbol block including different coded information for the data packet" (emphasis added), as recited in claim 15.

The rejection states that Tarokh does not teach "each symbol block including different coded information". The rejection then states that Lakkis describes this feature in the cited sections noted above. As discussed above for claim 1, the cited sections of Lakkis describe different spreading codes used for spreading multiple substreams of data. The cited sections of Lakkis do not describe a plurality of data symbol blocks comprising different coded information generated for a data packet.

Second, Tarokh appears to teach away from sending redundancy information. Paragraph [0024] of Tarokh states:

> "However, for transmission using multiple antennas, incremental redundancy schemes are not known. This is partially due to the fact that in a space-time channel, signals transmitted from different antennas superpose, and this makes it difficult to improve the transmitted signals with increasing redundancy. In this light, there is a need for a way to construct space-time codes to facilitate incremental redundancy in a spatially diverse communication environment."

Tarokh thus teaches away from using redundancy information (e.g., different coded information) to improve performance. Instead, Tarokh teaches sending the same symbols using space-time codes to improve performance.

For at least the above reasons, Applicant submits that claim 15 is patentable over Tarokh in view of Lakkis. Claims 16-19 are dependent on claim 15 and are patentable for at

least the reasons noted for claim 15. These dependent claims may recite additional features not disclosed nor suggested by Tarokh and Lakkis.

Independent claims 21, 23, 26 and 49 each recites the features noted above for claim 15. Claim 24 is dependent on claim 23, and claim 27 is dependent on claim 26. Claims 21, 23, 24, 26, 27 and 49 are patentable over Tarokh in view of Lakkis for at least the reasons noted above for claim 15.

Claim 28 of the present application, as amended, recites:

> "A method of receiving an incremental redundancy (IR) transmission in a wireless multiple-input multiple-output (MIMO) communication system, comprising:
>
> receiving a block of received symbols for a data packet, wherein the received symbol block is for a data symbol block transmitted from a plurality of transmit antennas at a transmitter and received by a plurality of receive antennas at a receiver, and wherein the data symbol block is one of a plurality of data symbol blocks generated for the data packet;
>
> detecting all received symbol blocks received for the data packet to obtain detected symbol blocks, one detected symbol block for each received symbol block;
>
> decoding the detected symbol blocks for the data packet to obtain decoder feedback information;
>
> performing the detecting and decoding for a plurality of iterations, wherein the decoder feedback information from the decoding for a current iteration is used by the detecting for a subsequent iteration; and
>
> generating a decoded packet based on an output from the decoding for a final iteration among the plurality of iterations."

Applicant submits that claim 28 is patentable over Tarokh for at least the following reason. Tarokh does not disclose "<u>performing the detecting and decoding for a plurality of iterations</u>, wherein <u>the decoder feedback information from the decoding for a current iteration is used by the detecting for a subsequent iteration</u>" (emphasis added), as recited in claim 28. The Examiner indicates that this feature of claim 28 is disclosed by Tarokh in paragraph [0083]. This paragraph states "note that equation 13 provides <u>zero-forcing</u> results for equation 12. Other, more sophisticated algorithms, such as <u>iterative MMSE</u> and <u>MLD</u>, can

be used to further improve the system performance." Tarokh mentions "iterative" only once and also mentions "MMSE" only once. Tarokh does not describe MMSE and also does not describe how iterative detection can be performed. Tarokh describes MLD in equations (4) through (8) and shows MLD operating on the received symbols $r_{1,m}$ and $r_{2,m}$. Although not described by Tarokh, MMSE also operates on the received symbols and provides detected symbols. Thus, it is not clear how MLD can be combined with MMSE since both operate on the received symbols. A reasonable interpretation of Tarokh might be "iterative MMSE" being one algorithm and "MLD" being another algorithm. Tarokh does not clearly describe iterative MMSE and MLD being one algorithm and further does not provide any teaching on how this algorithm can be performed, thus making it non-enabling.

In contrast, claim 28 clearly recites a two-step process that includes (i) detecting received symbols to obtain detected symbols and (ii) decoding the detected symbol blocks to obtain decoder feedback information, which is used by the detecting in a subsequent iteration. The "detecting" and "decoding" are thus performed on different symbols, and the output of one step is used as an input to the other step.

For at least the above reason, Applicant submits that claim 28 is patentable over Tarokh. Claims 29, 31 and 32 are dependent on claim 28 and are patentable over Tarokh for at least the reason noted for claim 28. These dependent claims may recite additional features not disclosed nor suggested by Tarokh.

Independent claims 33 and 35 each recites the features noted above for claim 28. Claim 34 is dependent on claim 33, and claim 36 is dependent on claim 35. Claims 33-36 are not anticipated by Tarokh for at least the reason noted above for claim 28.

Claim 37 of the present application, as amended, recites:

> "A method of receiving a data transmission in a wireless multiple-input multiple-output (MIMO) communication system, comprising:
>
> detecting received symbols for a data packet to obtain detected symbols;
>
> decoding the detected symbols to obtain decoder feedback information;
>
> performing the detecting and decoding for a plurality of iterations, wherein the decoder feedback information from the decoding for a current iteration is used by the detecting for a subsequent iteration, wherein the detecting is performed based on a minimum mean square error (MMSE) detector for at least one iteration initially, and

thereafter based on a maximal ratio combining (MRC) detector or a linear zero-forcing (ZF) detector for remaining ones of the plurality of iterations; and

generating a decoded packet based on an output from the decoding for a final iteration among the plurality of iterations."

Applicant submits that claim 37 is patentable over Tarokh for at least the following reasons.

First, Tarokh does not disclose "performing the detecting and decoding for a plurality of iterations, wherein the decoder feedback information from the decoding for a current iteration is used by the detecting for a subsequent iteration" (emphasis added), as recited in claim 37. The Examiner indicates that this feature of claim 37 is disclosed by Tarokh in paragraph [0083]. As discussed above for claim 28, Tarokh does not clearly describe iterative MMSE and MLD being one algorithm and further does not provide any teaching on how this algorithm can be performed, thus making it non-enabling.

Second, Tarokh does not disclose "wherein the detecting is performed based on a minimum mean square error (MMSE) detector for at least one iteration initially, and thereafter based on a maximal ratio combining (MRC) detector or a linear zero-forcing (ZF) detector for remaining ones of the plurality of iterations" (emphasis added), as recited in claim 37. The Examiner indicates that this feature of claim 37 is disclosed by Tarokh in paragraph [0083]. This paragraph describes using one algorithm, which may be zero-forcing, iterative MMSE, or MLD. This paragraph does not describe using one algorithm for the at least one iteration initially and thereafter using another algorithm for the remaining iterations, as recited in claim 37.

For at least the above reasons, Applicant submits that claim 37 is patentable over Tarokh. Claim 38 is dependent on claim 37 and is patentable for at least the reasons noted for claim 37.

Accordingly, the §102(e) rejection of claims 15-19, 22-24, 26-29, 31-40 and 49 should be withdrawn.

Rejection of Claims 21 and 42-48 Under 35 U.S.C. §103(a)

Claim 21 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Tarokh in view of Alouini (US 6,304,593) and further in view of Lakkis. The Examiner states that

Tarokh describes all of the features of claim 21 except for "determining a rate for data transmission based on an average spectral efficiency for a plurality of transmit antennas at a transmitter." The Examiner then states that Alouini describes this feature of claim 21. As discussed above, Tarokh and Lakkis do not disclose "each data symbol block including different coded information." Hence, Tarokh and Lakkis form an insufficient basis for the §103(a) rejection of claim 21. Alouini does not address the deficiencies of Tarokh.

Claims 42-48 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Tarokh in view of Haustein *et al* (US 7,366,520). Claims 42-48 are dependent on claims 15, 23, 26, 28, 33, 35 and 37, respectively. Tarokh does not disclose all of the elements of base claims 15, 23, 26, 28, 33, 35 and 37, as discussed above. Hence, Tarokh is an insufficient basis for the §103(a) rejection of dependent claims 42-48. Haustein does not address the deficiencies of Tarokh.

Accordingly, the §103(a) rejection of claims 21 and 42-48 should be withdrawn.

CONCLUSION

In light of the amendments contained herein, Applicant submits that the application is in condition for allowance, for which early action is requested.

Please charge the requisite fee to Deposit Account No. 17-0026. Please charge any fees or credit any overpayments that may be due with this response to Deposit Account No. 17-0026.

Respectfully submitted,

Dated: June 2, 2010

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